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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of:

Tetsuya WATANABE et al.

Appl. No. 09/981,807

Filed: October 19, 2001

For: SHAFT SEALING APPARATUS

Art Unit: 3676
Confirmation No. 7561

Examiner: Vishal A. Patel

Atty. Docket No. 36595-176071

Customer No.
26694
PATENT TRADEMARK OFFICE

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal to the Board of Patent Appeals and Interferences from the decision of the Examiner in the Office Action mailed August 22, 2003. A Notice of Appeal was filed on December 22, 2003.

A check for $330.00 is attached. If no check is attached or the submitted fee is deficient, please charge Deposit Account No. 22-0261. This Appeal Brief is being submitted in triplicate.

(1) REAL PARTY OF INTEREST

The Assignee of this application, and thus, the real party of interest in this appeal, is Teijin Seiko Co., Ltd. of Tokyo, Japan.

(2) RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

(3) STATUS OF CLAIMS

The claims involved in this appeal are set forth in the Appendix to this Brief. Claims 1-3 and 5 have been finally rejected and are being appealed. Claims 4 and 6-20 have been withdrawn from consideration as being drawn to nonelected species.

(4) STATUS OF AMENDMENTS

All Amendment have been entered.

(5) SUMMARY OF THE INVENTION

Referring to Figs. 1-3, the present invention is direct to a shaft sealing apparatus, and includes a vacuum casing 110 formed with a vacuum chamber 111. A driving shaft 130, 140 has an outer cylindrical surface 130b, 140b and movably extends in the vacuum chamber 111 of the vacuum casing 110. An annular sealing ring 153, 163 has a sealing lip 154c, 164c with an annular groove is held in contact with the outer cylindrical surface 130b, 140b of the driving shaft 130, 140. An annular spring member 155, 165 is received in said annular groove of the sealing lip 154c, 164c and is operative to impart a force to said sealing lip 154c, 164c to ensure that the sealing lip 154c, 164c is held in tight contact with the outer cylindrical surface 130b, 140b of the driving shaft 130, 140. A peripheral portion 154b, 164b radially outwardly extends from the sealing lip 154c, 164c. The outer

cylindrical surface 130b, 140b of the driving shaft 130, 140 has a surface roughness Ra of less than 0.1 μm.

(6) ISSUES

The following issues are presented to the Board:

Whether claims 1 and 3 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,383,691 to Potter ("Potter") in view of JP 60199544A to Azuma ("Azuma") and U.S. Patent No. 3,495,843 to Andersen et al. ("Andersen").

Whether claim 2 is properly rejected under 35 U.S.C. §103(a) as being unpatentable over Potter in view of Azuma, Andersen and further in view of U.S. Patent. No. 5,853,502 to Aihara ("Aihara").

Whether claim 5 is properly rejected under 35 U.S.C. §103(a) as being unpatentable over Potter in view of Azuma, Andersen and further in view of U.S. Patent. No. 4,331,339 to Reinsma ("Reinsma").

(7) GROUPING OF CLAIMS

The claims are grouped as follows:

Group I - Claims 1-3 and 5.

(8) ARGUMENTS

Group I

Claims 1 and 3 are rejected under 35 U.S.C. §103(a) as being unpatentable over Potter in view of Azuma and Andersen.

The present invention is defined in claim 1 as follows.

A shaft sealing apparatus, comprising:

(1) a vacuum casing formed with a vacuum chamber;

(2) a driving shaft having an outer cylindrical surface and movably extending in said vacuum chamber of said vacuum casing; and

(3) a sealing ring in the form of an annular ring shape and including a sealing lip held in contact with said outer cylindrical surface of said driving shaft and formed with an annular groove, an annular spring member received in said annular groove of said sealing lip and operative to impart a force to said sealing lip to ensure that said sealing lip is held in tight contact with said outer cylindrical surface of said driving shaft, and a peripheral portion radially outwardly extending from said sealing lip,

(4) in which said outer cylindrical surface of said driving shaft is smaller in surface roughness Ra than 0.1 (μm).

The claimed construction of the shaft sealing apparatus reduces size and production cost. In addition, the fact that the outer cylindrical surface of the driving shaft has a surface roughness Ra of less than 0.1 μm results in improved sealing of the gaps between the driving shaft and other parts around the driving shaft.

The Examiner has rejected claim 1 as being unpatentable over Potter in view of Azuma and Andersen.

The Examiner indicates in the Office Action that Potter discloses the invention substantially as claimed above with the following exception. The Examiner cites Andersen as disclosing an annular groove in the sealing lip, and the Examiner cites Azuma as disclosing a surface roughness Ra of less than 0.1 micrometer.

The cited references fail to teach feature (3).

Potter discloses "wear-resistant sleeve 13 at and in contact with the seal support 12 at the inner face thereof, the sleeve 13 being intended for contact with the shaft, not shown, arranged coaxially with the casing in the use condition of the assembly and being loaded into such contact by a close-coiled garter spring 14 provided at that side of the support 12 remote from the sleeve 13." Column 2, line 63 to column 3, line 2. Similarly Potter also discloses "The axial extent of the sleeve 13 exceeds that of the support 12 so as wholly to overlie the same at its inner conical surface, and the support 12 is provided with a rib 25 through which it bears on the sleeve 13 with substantially line contact. The garter spring 14 is located in axial alignment with rib 25. The support 12 and the sleeve 13 are positioned in the casing 11, with flange 20 of the sleeve interposed between flanges 16 and 19, and are maintained in such disposition by a retaining ring 21 acting through a washer 22, the retaining member 27 being held captive in the casing 11 by a swaged overlip 23 at the open end of the casing 11." Column 3, lines 25 to 37. Potter further states "In the static mode, as shown in Fig. 6, the free end of the sleeve 13 contacts the shaft 35 since the abovementioned hydrodynamic forces do not exist. In this configuration the plain portion 34 at the free end of the sleeve 13, to which the wind-back 30 does not extend, provides a seal with the shaft 35 so as to prevent leakage past the seal of the fluid being sealed whilst the shaft 35 is static." Column 4, lines 56 to 62.

As can be seen from the abovementioned description and Figs. 1-6 of Potter, the **wear resistant sleeve 13** forming part of the wind-back 30 is held partly in contact with the shaft 35 while **the support 12** has a rib 25 held in contact with the sleeve 13. Neither the support 12 nor the rib 25 is held in contact with the shaft 35. The Examiner states "Potter discloses the invention substantially as claimed above" but does not clearly point out what constitution elements of the seal assembly disclosed by Potter correspond to those of the shaft sealing apparatus according to the present invention as defined in claim 1.

If the sleeve 13 disclosed by Potter corresponds to the sealing ring defined in claim 1, the sleeve 13 disclosed by Potter **does not include a sealing lip** held in contact with the outer cylindrical surface of the driving shaft and formed with an annular groove, and an annular spring member received in the annular groove of the sealing lip as defined in claim 1. If, on the other hand, the support 12 disclosed by Potter is correspondent to the sealing ring defined in claim 1, the support 12 disclosed in Potter is certain to include a sealing lip held in contact with the sleeve 13 but **not in contact with the outer cylindrical surface of the shaft 35**. Moreover, the support 12 disclosed by Potter is not formed with an annular groove and does not include an annular spring member received in the annular groove of the sealing lip as defined in claim 1 As seen from at least Figs. 5 and 6 of Potter, there is a sleeve 13 intervening between the support 12 and the shaft 35 to prevent the rib 25 and the support 12 from being held in contact with the shaft 35, and thus, the support 12 is not held in contact with the shaft 35.

Therefore, Potter fails to disclose: (3) a sealing ring in the form of an annular ring shape and including a sealing lip held in contact with the outer cylindrical surface of the

driving shaft and formed with an annular groove, an annular spring member received in the annular groove of the sealing lip is held in tight contact with the outer cylindrical surface of the driving shaft, and a peripheral portion radially outwardly extending from the sealing lip", as disclosed in claim 1.

To establish prima facie obviousness of the claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974); In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970) ("All words in a claim must be considered in judging the patentability of the claim against the prior art.").

It would not be obvious to modify the cited references to result in the surface roughness recited by claim 1 because Azuma teaches away from the claimed invention.

The Examiner indicates in the Office Action that "It would have been obvious to one having ordinary skill in the art at the time the invention was made to configure the outer cylindrical surface to have a surface roughness that is smaller in surface roughness Ra than 0.1 micrometer as taught by Azuma." Particularly, the Examiner argues that Azuma discloses a surface roughness specified by JIS-B0601.

For an understanding of Azuma, the description on page 234 from line 14 in left column to line 3 in right column of the Azuma, as translated from Japanese into English, states: *"A casting mold 13 is produced by a mold 16 coated with a mold releasing agent 21. The mold releasing agent 21 is placed on the surface of casting mold 13 after the mold 16 is remolded by the casting model. After the mold 16 is produced, the mold 16*

removed from the casting model 13. The surface of the mold 16 thus produced has a roughness of 10s or less. The mold releasing agent 21 makes it possible to remarkably reduce the friction resistance of the mold 16 to the casting mold 13. Accordingly, the mold 16 thus produced can be released from the casting mold 13 in extremely easy manner."

A surface roughness R_{max} of 0.6S corresponds to a surface roughness Ra of 0.1μm. Azuma discloses a surface roughness R_{max} of 10S. Thus, it is clear that Azuma discloses a **much higher surface roughness** than claimed in claim 1. Accordingly, it would be understood by one of ordinary skill in the art that the surface roughness disclosed in Azuma is extremely rough as compared with the surface roughness of the present invention and as defined in claim 1. The extremely large difference in the surface roughness between the outer surface of the driving shaft of claim 1 and the outer surface of the shaft 1 disclosed in Azuma is attributed to the fact that the driving shaft is movably extending in the vacuum chamber of the vacuum casing and held in contact with the sealing lip of the sealing ring in the shaft sealing apparatus according to the present invention as defined in claim 1, while the crank shaft 1 is formed in the casting mold 13 and released from the casting mold 13 in the casing method disclosed in Azuma. More specifically, the driving shaft is held in sliding contact with the sealing lip of the sealing ring while being rotated in the vacuum chamber of the vacuum casing in the shaft sealing apparatus according to the present invention as defined in claim 1, while the shaft 1 is formed in the casting mold 13 but not rotated in the casting mold 13 in the casing method disclosed in Azuma. Thus, surface roughness disclosed in the Azuma does not need to be as small as the surface defined in claim 1. **As a result, Azuma leads away from the**

claimed invention, and as such teaches away from the surface roughness recited by claim 1. See Micro Chemical, Inc. v. Great Plains Chemical Co., Inc., 103 F.3d 1538, 41 USPQ 1238 (Fed. Cir. 1997), cert. denied, 521 U.S. 122 (1997). In the very least, there is no motivation to combine the references.

At the bottom of page 3 of the Office Action, the Examiner argues that the surface roughness recited in claim 1 is "discovering an optimum value of a result effective variable only involves only routine skill in the art," and thus, would be obvious. However, this statement ignore the fact that Azuma teaches away the claimed limitation.

Therefore, Azuma, Potter and Andersen fails to disclose that the outer cylindrical surface of driving shaft is smaller in surface roughness Ra than 0.1 micrometers. This feature results in excellent sealing in the gaps between the driving shaft and other parts around the driving shaft cannot also be expected from the prior art references.

For the reasons stated above, it is respectfully submitted that claim 1 is allowable over the cited prior art. Claim 3 depends from claim 1 and is allowable as depending from as allowable claim.

Claim 2 is rejected under 35 U.S.C. §103(a) as being unpatentable over Potter and Azuma as applied to claim 1 above, and further in view of U.S. Patent No. 5,853,502 to Aihara. Claim 2 depends from claim 1. Aihara fails to cure the deficiency in the rejection of claim 1. As such, claim 2 is allowable over the cited prior art.

Claim 5 is rejected under 35 U.S.C. §103(a) as being unpatentable over Potter and Azuma as applied to clam 1 above, and further in view of U.S. Patent No. 4,331,339 to

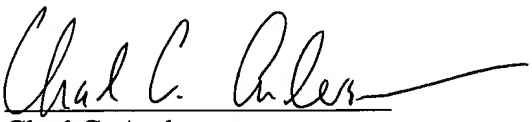
Reinsma. Claim 5 depends from claim 1. Reinsma fails to cure the deficiency of claim 1. As such, claim 5 is allowable over the cited prior art.

Therefore, it is respectfully requested that the rejections of claims 1-3 and 5 be reversed.

(9) CONCLUSION

For the foregoing reasons, it is respectfully submitted that each of the pending claims is patentable over the cited references. Accordingly, the Examiner's rejection of these claims should be reversed.

Respectfully submitted,



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APPENDIX

Claim 1. A shaft sealing apparatus, comprising:

a vacuum casing formed with a vacuum chamber;

a driving shaft having an outer cylindrical surface and movably extending in said vacuum chamber of said vacuum casing; and

a sealing ring in the form of an annular ring shape and including a sealing lip held in contact with said outer cylindrical surface of said driving shaft and formed with an annular groove, an annular spring member received in said annular groove of said sealing lip and operative to impart a force to said sealing lip to ensure that said sealing lip is held in tight contact with said outer cylindrical surface of said driving shaft, and a peripheral portion radially outwardly extending from said sealing lip, in which said outer cylindrical surface of said driving shaft is smaller in surface roughness Ra than 0.1 (μm).

Claim 2. A shaft sealing apparatus as set forth in claim 1, in which said outer cylindrical surface of said driving shaft is larger in Vickers hardness Hv than 650.

Claim 3. A shaft sealing apparatus as set forth in claim 1, in which said annular spring member of said sealing ring is made of a metal wire in the form of a helical shape and is of a circular cross-section taken on the plane perpendicular to the center axis passing therethrough.

Claim 5. A shaft sealing apparatus as set forth in claim 1, in which said sealing lip of said sealing ring is made of a synthetic resin constituted by an ultra high molecular weight compound.